Claims

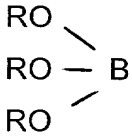
1. A lubricating oil composition, comprising:

(A) a base oil;

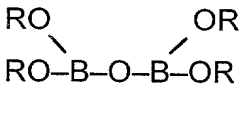
(B) a molybdenum and sulfur containing composition derived from a basic nitrogen containing compound, a molybdenum compound and carbon disulfide;

(C) a boron-containing compound selected from the group consisting of:

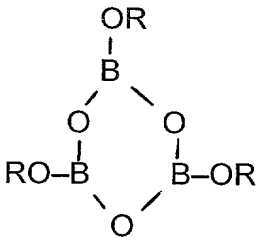
(C-I) a borated ester represented by one or more of the formulae



or



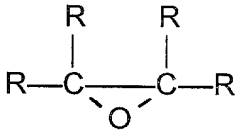
or



(C-I-1) (C-I-2) (C-I-3)

wherein in formulae (C-I-1), (C-I-2) and (C-I-3), each R is independently a hydrocarbon group and any two adjacent R groups may together form a cyclic group;

(C-II) at least one borated epoxide comprising the product made by reacting a boron reactant with one or more epoxides represented by the formula



(C-II-1)

wherein in formula (C-II-1) each R is independently hydrogen or a hydrocarbon group and any two adjacent R groups may together form a cyclic group, with the proviso that when a single epoxide is used the total number of carbon atoms in the R groups does not exceed about 12, and when a mixture of epoxides is used the

average on a mole basis for the total number of carbon atoms in the R groups for the mixture does not exceed about 12; and

(C-III) mixture of (C-I) and (C-II); and

(D) optionally a phosphorus containing compound, provided the phosphorus content of the lubricating oil composition does not exceed about 0.10% by weight.

2. The composition of claim 1 wherein the basic nitrogen containing compound is reacted with the molybdenum compound to form a molybdenum containing intermediate, and the molybdenum containing intermediate is reacted with carbon disulfide to form the molybdenum and sulfur containing composition.

3. The composition of claim 1 wherein the basic nitrogen containing compound is reacted with the carbon disulfide to form a sulfur containing intermediate, and then the sulfur containing intermediate is reacted with the molybdenum compound to form the molybdenum and sulfur containing composition.

4. The composition of claim 1 wherein the basic nitrogen containing compound is the product made by reacting a carboxylic acid or reactive equivalent thereof with an alkylene polyamine.

5. The composition of claim 1 wherein the basic nitrogen containing compound is a hydrocarbyl amine.

6. The composition of claim 1 wherein the basic nitrogen containing compound comprises a mixture of a hydrocarbyl amine and the product made by reacting a carboxylic acid or reactive equivalent thereof with an alkylene polyamine.

7. The composition of claim 4 wherein the carboxylic acid or reactive equivalent thereof has about 8 to about 34 carbon atoms per molecule.

8. The composition of claim 4 wherein the carboxylic acid or reactive equivalent thereof is a fatty acid.

9. The composition of claim 4 wherein the carboxylic acid or reactive equivalent thereof is hydrocarbon substituted carboxylic or reactive equivalent thereof made by reacting one or more alpha, beta olefinically unsaturated carboxylic acid reagents containing 2 to about 20 carbon atoms, exclusive of the carboxyl groups, with one or more olefin polymers.

10. The composition of claim 4 wherein the alkylene polyamine is a compound represented by the formula

$$\begin{array}{c} RN\text{-}(R^1\text{-}N)_n\text{-}R \\ \quad | \qquad | \\ \quad R \qquad R \end{array}$$

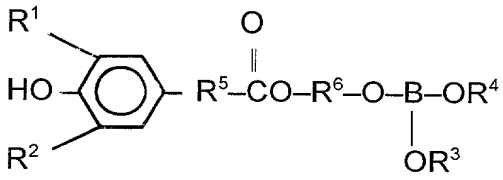
wherein n is from 1 to about 14; each R is independently a hydrogen atom, a hydrocarbyl group or a hydroxy-substituted or amine-substituted hydrocarbyl group having up to about 30 atoms, or two R groups on different nitrogen atoms are joined together to form a R^1 group, with the proviso that at least one R group is a hydrogen atom, and R^1 is an alkylene group of about 1 to about 10 carbon atoms.

11. The composition of claim 4 wherein the carboxylic acid or reactive equivalent thereof is isostearic acid and the alkylene polyamine comprises alkylene polyamine bottoms.

12. The composition of claim 6 wherein the hydrocarbyl amine is oleyl amine and the product made by reacting a carboxylic acid or reactive equivalent thereof with an alkylene polyamine is a polyisobutene substituted succinimide.

13. The composition of claim 1 wherein the molybdenum compound is MoO_3.

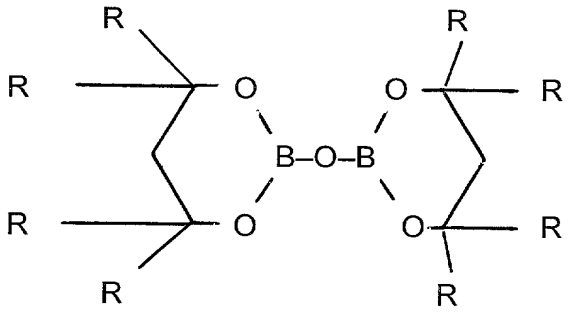
14. The composition of claim 1 wherein the boron containing compound is a borated ester represented by the formula



(C-I-1-a)

wherein in formula (C-I-1-a): R^1, R^2, R^3 and R^4 are independently hydrocarbon groups of 1 to about 12 carbon atoms; and R^5 and R^6 are independently alkylene groups of 1 to about 6 carbon atoms.

15. The composition of claim 1 wherein the boron-containing compound is a borated ester represented by the formula:

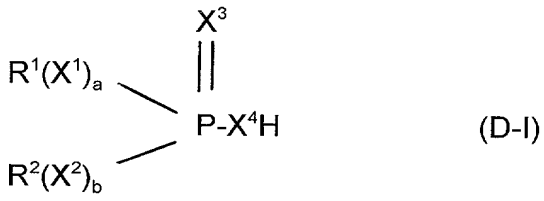


(C-I-2-a)

wherein in formula (C-I-2-a), each R is independently hydrogen or a hydrocarbon group.

16. The composition of claim 1 wherein the boron-containing compound is tri-n-butyl borate.

17. The composition of claim 1 wherein the phosphorus containing compound is a metal salt of a compound represented by the formula



(D-I)

wherein in formula (D-I): X^1, X^2, X^3 and X^4 are independently oxygen or sulfur, a and b are independently zero or one, and R^1 and R^2 are independently hydrocarbyl groups.

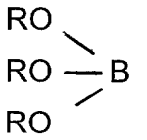
18. The lubricating oil composition of claim 1 wherein the lubricating oil composition further comprises a detergent, dispersant, corrosion-inhibiting agent, oxidation-inhibiting agent, viscosity index modifier, dispersant viscosity index modifier, pour point depressing agent, extreme pressure agent, antiwear agent, friction modifier, anti-foam agent, or mixture of two or more thereof.

19. A lubricating oil composition, comprising:

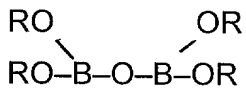
(A) a base oil;

(B) a molybdenum and sulfur containing composition derived from: the product made by reacting a fatty acid with an alkylene polyamine; MoO_3; and carbon disulfide;

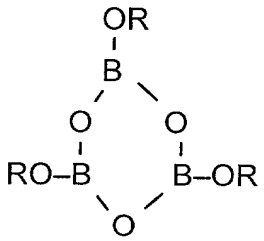
(C) a borated ester represented by one or more of the formulae



or



or



(C-I-1) (C-I-2) (C-I-3)

wherein in formulae (C-I-1), (C-I-2) and (C-I-3), each R is independently a hydrocarbon group and any two adjacent R groups may together form a cyclic group; and

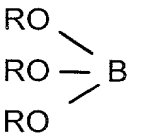
(D) optionally a zinc dialkyl dithiophosphate, provided the phosphorus content of the lubricating oil composition does not exceed about 0.10% by weight.

20. A lubricating oil composition, comprising:

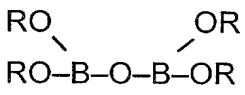
(A) a base oil;

(B) a molybdenum and sulfur containing composition derived from: a polyisobutene substituted succinimide; oleyl amine; MoO_3; and carbon disulfide;

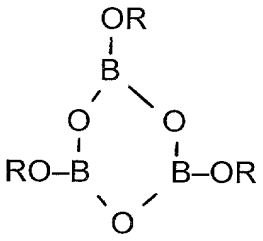
(C) a borated ester represented by one or more of the formulae



or



or



(C-I-1) (C-I-2) (C-I-3)

wherein in formulae (C-I-1), (C-I-2) and (C-I-3), each R is independently a hydrocarbon group and any two adjacent R groups may together form a cyclic group; and

(D) optionally a zinc dialkyl dithiophosphate, provided the phosphorus content of the lubricating oil composition does not exceed about 0.10% by weight.